Alberta
ENERGY
Research and
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Branch

Studies of Coal Slurry Systems and Alternative Coal Transportation Methods

Projects supported in part
by the Alberta/Canada
Energy Resources
Research Fund

ALBERTA
OFFICE OF
COAL
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Foreword

Beginning in 1976, numerous projects were initiated in Alberta by industry and academic research institutions to help make better use of Alberta's energy resources.

These research, development and demonstration efforts were funded by the Alberta/Canada Energy Resources Research Fund (A/CERRF), which was established as a result of the 1974 agreement on oil prices between the federal government and the producing provinces.

Responsibility for applying and administering the fund rested with the A/CERRF Committee, made up of senior Alberta and federal government officials.

The priorities of the A/CERRF program focused primarily on coal, energy conservation and renewable energy, and conventional energy resources. In 1988/89, a hydrogen research component was added.

Administration for the A/CERRF program was provided by staff within the Research and Technology Branch of Alberta Energy.

In recognition of the importance of coal to Alberta's economy, the Alberta Office of Coal Research and Technology was established in 1984 within Alberta Energy and Natural Resources (now Alberta Energy). Its primary purpose is to encourage the development and application of new technologies related to Alberta coals. The Office provides funding contributions to research and development projects in industry, academic institutions and other research establishments. It also monitors the progress of these projects in an overall program of improving the production, transportation and marketability of Alberta coals.

The A/CERRF program ended on March 31, 1991, and the support it provided has been replaced by funding from the Alberta government.

A series of technology transfer booklets, begun in 1986 with A/CERRF support, continues to make research results available to industry and others who can use the information.

This service will continue until all A/CERRF projects have been described.

For more information about other publications in the series, please refer to page 12.

Studies of Coal Slurry Systems and Alternative Coal Transportation Methods

To transport Alberta coal to Ontario, and to west coast ports for shipment overseas, railway companies currently use "unit trains" capable of hauling 10 000 tonnes of coal at a time. Because rail haul distances are long, transportation costs represent a significant portion of the overall costs of purchasing Alberta coals. For example, rail haul accounts for 35 per cent of all the costs to mine, clean and deliver Alberta coals to Pacific ports. Nevertheless, those total costs were still low enough to be competitive in world markets during the 1970s and early 1980s. That situation changed during the last decade, and now reductions and improvements in efficiency are needed if Alberta coals are to remain cost-competitive.

Therefore, several research projects were undertaken in Alberta, with partial funding by A/CERRF, to examine ways for reducing coal transportation costs. Each element in the mine-to-customers chain was studied. This included investigations of some transportation alternatives including proposals to use pipelines to move slurries of Alberta coal over short and long distances.

A typical unit train enroute to west coast terminals.
(Photo courtesy of Canadian National Railways)

An Economic Analysis of Coal Pipeline Systems

The technical feasibility of moving coal slurries to the west coast by pipeline was demonstrated in a 1980 study. It prompted a subsequent examination in 1984 of the economics of transporting a variety of slurry configurations by pipeline. This study, which was co-funded by A/CERRF through the Alberta Office of Coal Research and Technology, and by Pembina Resources Limited of Calgary, was performed by several research groups under the direction of Pembina Resources. Results of the investigation were published in 1985 in a two-volume report entitled "Slurry Pipeline System Investigation of Western Canadian Coals."

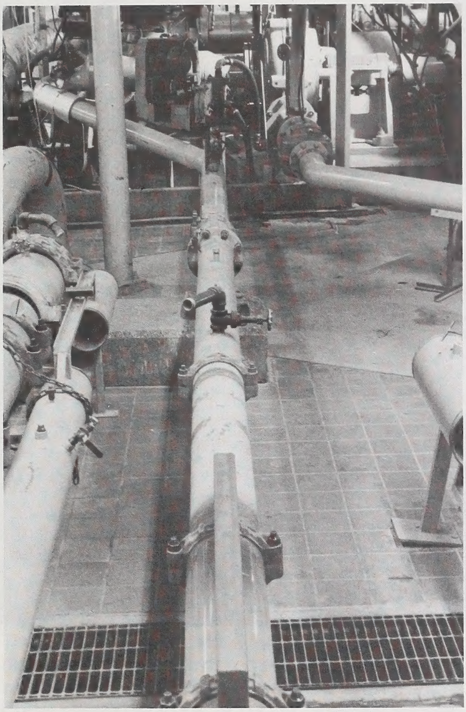
While estimates of coal behaviour in a pipeline can be made from generalized correlations that consider the physical properties of coal, the investigators regarded this as an unsatisfactory approach when several types of coal slurry systems are to be compared with each other.

It was thought a more useful comparison could be made if experimental results for the different pipelining methods were available. Furthermore, each coal slurry involves different coal preparation techniques that can alter the way coal is handled at the tidewater end of the pipeline. Therefore, it was felt that a comprehensive economic analysis must consider not only the pipeline portion of the delivery system, but must also weigh the influence of coal cleaning and slurry preparation on costs, as well as any costs associated with recovery and storage of coal at the delivery terminal. Also, any economic consideration of coal delivery options should make allowance for the need to transport coal over short or long distances.

Having established these criteria as the basic requirements of the study, the investigators went on to examine three types of thermal coals, in five coal slurry systems, over three transportation distances.

The three Alberta coals used in the experimental test programs were:

- raw and washed high-volatile bituminous coals from the Foothills region; and
- raw subbituminous coal from the Plains region.



Coarse-coal slurries were studied in this pipeline at Saskatchewan Research Council.

They were transported in five slurry systems, namely:

- slurries having a fine-particle size distribution;
- slurries with an intermediate-particle size distribution;
- coarse-particle size distribution slurries;
- dense-phase coal-water mixtures; and
- agglomerated coal slurries.

The three transportation distances were classified as:

- long (1 000 km), representing transportation to the west coast or Ontario;
- intermediate (300 km), representing transportation for fuel uses within Alberta; and
- short (25 km), representing local transportation from a mine to a cleaning plant or railway.

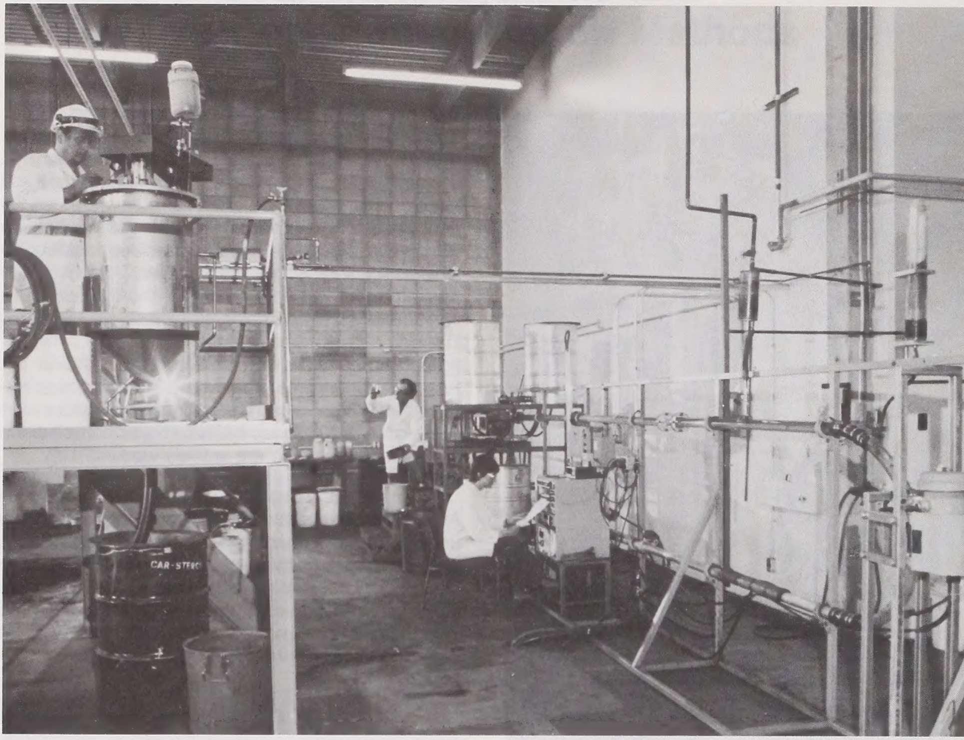
To provide a basis for detailed technical and economic comparisons of the various alternatives, hydraulic studies were carried out using laboratory-scale pipelines at three research facilities. Pipeline loop tests using 50-mm diameter pipe were performed at the research laboratory of Pembina Resources. Here, fine and intermediate particle size distribution slurries were studied. At the Saskatchewan Research Council, the hydraulic characteristics of coarse coal slurries were measured in loops of 158-mm diameter pipe, while agglomerated coals were studied at the Alberta Research Council as they moved through loops of 50-mm diameter pipe. The hydraulic behaviour of coal-water mixtures was estimated after consultation with researchers who are actively working with them.

After hydraulic characteristics were measured under laboratory conditions, mathematical models were used to predict the behaviour of each type of slurry in commercial-scale pipelines capable of carrying two million or more tonnes of coal a year. Two mathematical models were used. They were the Pseudofluid Method and the Parameter Matching Method.

Hydraulic Characteristics

In the case of fine-particle size distribution slurries, the results of hydraulic testing were found to be consistent with previous measurements and behaviour of these types of slurries. This was taken to mean that projections concerning hydraulic behaviour in commercial-scale pipelines should be reliable even with the large degree of scale-up that would be required for pipelines capable of carrying up to 10 million tonnes of coal a year.

On the other hand, intermediate-particle size distribution slurries have not been studied extensively in the past. With a rather limited background of data to use as a reference point, and because complications were created by a significant load of suspended solids, researchers working on this type of slurry found that the projected hydraulic behaviour in scaled-up systems was less reliable than for fine-particle size distribution slurries. In turn, this greater amount of uncertainty was reflected in a lower degree of confidence in the economic estimates that were made.



The hydraulic behaviour of agglomerated coals was investigated using a pilot-scale pipeline loop at Alberta Research Council.

Because coarse coal slurries were studied in a pipeline that was relatively large in comparison with those used for other slurries, the investigators believed the projected hydraulic behaviour of coarse-coal slurries in commercial-scale pipelines could be used with a high degree of confidence.

In the case of agglomerated coals, there was little information on their hydraulic characteristics, and no satisfactory model of flow behaviour was available. Consequently, economic analyses suffer from a lower degree of confidence caused by a lack of important information, such as the relationship between particle size and pipe diameter.

Economic Analysis

In terms of energy delivery, the most promising pipeline option for moving two million tonnes of coal a year over a distance of 1 000 kilometres is to transport washed bituminous coal in the form of a fine-particle size distribution slurry. It was also found that costs are sensitive to economies of scale. When throughput is increased from two million to 10 million tonnes a year, pipeline operating costs are predicted to drop by 50 per cent while the costs to operate the coal/slurry preparation plant and the dewatering and drying facility decrease by 35 per cent.

Intermediate-particle size distribution slurries showed higher operating costs because pressure gradients in the pipeline were higher, but the investigators believed the economic projections for this configuration and for agglomerated coals were incomplete because the scale-up calculations have a low level of confidence.

Estimated Direct Costs for Slurry Pipelining ($/tonne-km)

	5 km	25 km	300 km	1000 km Without drying	1000 km With drying
Fine-Coal Slurry	–	–	$0.01 - $0.03	$0.012 - $0.015	$0.021 - $0.023
Intermediate-Coal Slurry	–	–	–	$0.012 - $0.015	$0.021 - $0.023
Coarse-Coal Slurry	$0.19	$0.08	–	–	–
Dense-Phase Coal-Water Mixture	–	–	–	$0.035	–
Agglomerated-Coal Slurry	–	–	–	$0.056	–

(Source: *Slurry Pipeline System Investigation of Western Canadian Coals*, Pembina Resources Limited)

The costs to deliver dense coal-water mixtures by pipeline are higher because the necessary coal grinding and chemicals used in the agglomeration system are expensive. This also results in a higher mining cost. This is because more extensive beneficiation is required which results in lower coal yields.

On the basis of two million tonnes a year, pipeline transport was examined for intermediate distances to allow comparisons between washed and unwashed coal in the form of a fine-particle size distribution slurry. The least expensive option was found to be delivery of raw subbituminous coal, although washed subbituminous is only about 25 per cent more expensive on the basis of delivered energy. It costs an additional 25 per cent to transport raw bituminous coal.

The most likely applications for delivery over short distances would be, for example, transportation within a plant site or from a mine to a wash plant. Under these conditions, economic analyses showed that the costs to transport coarse-coal slurries made from raw bituminous coal were representative of the other coals that were studied.

Of particular interest to the coal industry, researchers at Pembina Resources found that, on a per tonne-kilometre basis, the projected operating costs for slurry pipelines that could carry coal 1 000 km, ranged from $0.012 to $0.015 for fine coal and intermediate coal slurries without drying, or from $0.021 to $0.023 with drying. On an equal delivery basis, this amounted to about $23 a tonne which, when mining costs of up to $25 a tonne are added, is competitive with present costs of approximately $45 to mine coal and deliver it by rail to west coast ports. Costs for other slurry systems and for other transportation distances are shown in the accompanying table.

Recent Coal-Slurry Studies

During the early 1980s, experiments carried out by an Alberta coal producer indicated that its low-volatile bituminous coking coal would be suitable for use in a coal-water fuel called DENSECOAL. The process for producing this slurry form of coal was developed by Salzgitter Industriebau GmbH (now Salzgitter Anlagenbau) in Germany.

Studies of DENSECOAL have shown that it can be substituted for fuel oil in oil-fired power stations and industrial installations. This material has a high solids content (approximately 70 per cent) and does not need to be dewatered before it is burned. DENSECOAL can also be stored and handled in the same manner as fuel oil.

In addition to these advantages, coal-water fuels can be transported by pipeline, thus providing an alternative to conventional rail transport of bulk coal. Despite the current low prices of fuel oil, which are hindering efforts to develop coal-water fuels that can compete economically with oil, the long-term prospects for substituting coal-water fuel in place of fuel oil are promising in locations such as Central America, Pacific Rim countries and in several Caribbean countries.

To investigate coal-slurry systems further and develop alternative coal transportation methods suitable for moving Alberta coals to various markets, a coal transportation research program was initiated in 1984. It was funded primarily by A/CERRF, and administered by the Alberta Office of Coal Research and Technology. One project was supported by the Action Committee on Western Canadian Low-Sulphur Coal to Ontario.

Conversion of a Power Station to Coal-Water Fuel

The initial investigation carried out in the coal-water fuel research program was a study to determine the suitability and the costs of converting an oil-fired boiler to one capable of burning DENSECOAL. The boiler chosen for the study was located at the Rio Haina power station owned by the Corporación Dominicana de Electricidad in the Dominican Republic.

In this engineering feasibility study, it was assumed that DENSECOAL made from an Alberta low-volatile coking coal would be transported to the west coast of Canada and then shipped to the Dominican Republic. There it would be burned in a boiler that had been converted to burn either DENSECOAL or #6 fuel oil.

It was concluded that conversion of the boiler was feasible, and the #6 fuel oil being burned in the boiler at the time could be used as an alternate fuel. When burning DENSECOAL made from the low-volatile coal, however, the boiler would have to be derated to only 60 per cent of the steam-production capacity as compared to the use of #6 oil as the fuel.

This exercise demonstrated that although the combustion characteristics of this particular DENSECOAL had been shown to be promising in previous combustion tests, more work was necessary if it was to become truly competitive with fuel oil.

This work, which was subsequently carried out in the late-1980s, will be the subject of a future technology transfer publication.

Coal Market Access Model

In July 1988, Trimac Consulting Services Ltd., of Calgary, completed an initial mathematical model of coal movements from a hypothetical mine in Alberta to a hypothetical power plant in southern Ontario. Lotus 1-2-3 software was used to perform a computer analysis of an extensive network of activities and options associated with coal production, delivery and use. Each of these activities and options was treated as a module in a network of interconnected modules. This provided a framework for ready addition, deletion or detailed investigation of individual modules. In this way, the model functions as an information bank, in which up-to-date data may be stored on operational performance and the economics of coal production and delivery systems.

The model allows analysis of many combinations of options to arrive at a minimum delivered cost, expressed in \$/GJ. Therefore, each movement of coal through every module is described in terms of:

- quantity of material transported or handled (in tonnes);
- calorific value (in GJ/tonne);
- per cent sulphur;
- per cent volatiles;
- per cent ash;
- per cent moisture; and
- per cent fixed carbon.

The model evaluates the effects of various options on: capital investment and return (pretax) for assets over specified economic lifetimes of up to 40 years; system requirements in terms of plant capacity; fleet size; throughput and unit cost per tonne and for each delivered energy unit; per cent of capacity usage; and employment by province or region.

Several delivery options were investigated. They were:

- the current method of rail delivery to Thunder Bay, plus marine delivery to the hypothetical power station;
- coal/oil agglomeration, followed by pipelining to Duluth, Minnesota and marine delivery to the power station;
- coal/oil agglomeration, plus pipelining directly to the power station;
- coal/oil agglomeration, followed by pipelining to Vancouver and ship transport via the Panama Canal and the St. Lawrence Seaway to the power plant;
- direct rail shipment to the power plant;
- rail haul to west coast ports, followed by marine transport via the Panama Canal/St. Lawrence Seaway to the power plant;
- the use of enhanced payload rail cars for transportation to Thunder Bay, Vancouver or directly to the power plant;
- calorific upgrading of coals by the addition of bitumen or heavy oils; and
- generation of electricity near the mine, followed by "cascading" over an interprovincial electricity grid to southern Ontario.

In the coal/oil agglomeration options, it was assumed that slurries sent to Duluth or directly to the power station would be de-oiled before combustion. The oil would be sold either in Chicago or Windsor/Sarnia. In the case of pipelining to the west coast, the oil would be removed at the terminal to allow ship transportation of solid coal.

Information used to describe the hypothetical mine was obtained from the literature and by consulting with mining and materials-handling engineers. A truck-and-shovel operation was assumed, along with a maximum, annual, clean coal production of seven million tonnes. The coal-washing plant was assumed to be a 1 000 tonne-a-day operation comprising a raw-coal truck dumper, bradford breaker, coarse-coal drum cleaners, heavy medium cyclones, washing cyclones, a fluidized bed clean-coal dryer and a tailings diverter system.

The bitumen enrichment facility was assumed to be capable of mixing 520 000 tonnes of residual oil from Edmonton refineries and 3.2 million tonnes of clean coal annually. This would raise the calorific value of coal from 24.5 to 27.6 GJ/tonne. Capital and operating costs were estimated at $9 million and $22.89 a tonne, respectively.

Published data and information obtained from interviews were used to describe rail loading operations, port facilities and rail car dumping, as well as blending and storage of coal and electricity generation efficiencies at the power plant. Similarly, specific assumptions were made about the preparation and de-oiling of coal/oil slurries and marine transport of solid coal.

Railway turnaround times were assumed to be six days from the mine to Thunder Bay, 4.5 days from the mine to Vancouver and 10 days from the mine to the power station.

Because various estimates exist of the potential cost savings available from proposed high-efficiency rail cars, a conservative estimate of 10 per cent rate reduction was used in the model.

Results

Movement of coal from the mine to the power plant was considered for three options: 1.5, 3.0 and 7.0 million tonnes a year. It was found that the best option used high-efficiency rail technology on the current transportation system at 3.0 million tonnes annually. This was expected to supply coal for $71.10 a tonne, or $2.90 a gigajoule.

Comparison of Delivered Cost of Coal to Stockpile at Hypothetical Power Station by Various Alternative Routes

(Three million tonnes a year, over 13 years from 1987 to 2000)

Route	$/Tonne	$/GJ	Annual Tonnes
High-Efficiency Rail to Thunder Bay	$71.10	$2.90	3 000 000
Conventional Rail to Thunder Bay	$72.11	$2.95	3 000 000
Direct Rail, Mine to Power Station	$84.86	$3.47	3 000 000
Bitumen Enrichment and Conventional Rail to Thunder Bay	$96.58	$3.50	2 660 435*
Conventional Rail to Vancouver, Ship via Panama Canal	$87.10	$3.56	3 000 000
Coal-Oil Agglomeration with Pipelining Directly to Power Station	$103.08	$3.88	2 765 650*
Coal-Oil Slurry via Duluth	$104.01	$3.92	2 765 650*
Coal-Oil Slurry to Vancouver, Ship via Panama Canal	$126.88	$4.78	2 765 650*

*equivalent gigajoules

(Source: Coal Market Access Model, Trimac Consulting Services Ltd., July 1988.)

Current rail haul to Thunder Bay, followed by marine transport to the power plant, was found to be the second best option.

In this study, the mathematical model was used to answer the question, "By what route is coal moved most economically from an Alberta mine to an Ontario power station?" The model could be used for other purposes as well. For example, it could be used to determine which coal can be applied most economically to meet a specific market demand. Also, it could be used to predict the appropriate times for expansion of capacity in the delivery system.

Of greatest importance to Alberta coal producers, the mathematical model has the potential to assist in identifying new marketing and logistical strategies in both the Ontario and Asian markets. It could also provide useful information to producers before they enter into negotiations with suppliers of transportation services. As well, the model could be used to assess new technologies or improvements to old ones. This could have a direct bearing on the viability of proposed high-efficiency rail cars, as well as alternative systems such as slurry pipelines.

Coal-Oil Slurry Pipelining

It has been estimated that the cost of transporting Alberta coal to Ontario can be reduced by $10-$15 a tonne if slurries of coal and oil are pumped through existing oil pipelines, rather than being shipped in bulk by rail as is done now.

Before the commercial potential of such a scheme could be determined, however, a detailed analysis of alternative methods for introducing coal-oil slurries into pipelines was needed. For instance, assuming the pipeline is also used to transport oil, the question of whether oil is contaminated by the coal had to be addressed. Furthermore, the feasibility of the concept depended on an ability to produce stable slurries economically and separate them into their respective coal and oil components at the delivery end of the pipeline.

In a multi-year project conducted by Unocal Canada Limited, a coal-oil transportation concept known as transCOM was developed. Financial support for this project was provided by Unocal Canada Limited, the Ontario Ministry of Energy, the federal Department of Western Economic Diversification and the Alberta Office of Coal Research and Technology. Some of this funding was made possible by the Action Committee on Western Canadian Low-Sulphur Coal to Ontario.

Some of the work in this project was performed at the Saskatchewan Research Council in Saskatoon, and by the Alberta Research Council in Nisku, Alberta. One of the first activities carried out was to determine the effect of coal particle size distribution on coal-oil slurry characteristics. In addition to this laboratory assessment, different techniques for separating coal-oil slurries were evaluated.

It was found that the viscosity of coal-oil slurries can be controlled and pipeline-stable slurries can be created. Using a light, sweet Alberta oil and Obed Mountain coal, of which 60-70 per cent was finer than 200 mesh, coal-oil slurries were prepared that contained 50 per cent coal by weight. The viscosity of these slurries in turbulent flow was found to be 4-6 times greater than the oil from which the slurry had been prepared, and more than 10 times greater in laminar flow.

Then, laboratory testing produced a procedure for preparing stable slurries capable of long-term storage that could be easily redispersed under turbulence. Also, procedures were developed to separate 94-97 per cent of the oil from the coal at the customer end of the pipeline. This separation method used a screen bowl centrifuge to recover most of the oil, followed by screen washing with solvent or diluent, and drying. Continuous recovery of approximately 95 per cent of the oil was accomplished at the bench scale.

Analysis of the recovered coal and oil showed that feed and recovered coal were similar. The same was true for oils, except the asphaltene and sulphur contents of the recovered oil were slightly less than in some of the oils tested.

At this stage of the project, the transCOM concept of long-distance transport of coal-oil slurries in a commodity pipeline had been demonstrated. It was found that coal sedimentation could be controlled, the slurry rheological characteristics were acceptable, and coal/oil separation could be accomplished by adapting existing commercial-scale equipment.

An application for a patent was made.

Having successfully demonstrated the transCOM technology at both the laboratory and bench scales, the project was extended to allow the entire chain of preparation, transportation and separation stages to be scaled up.

Basic work was undertaken to determine the optimum process for preparing these unique slurries. This included studying dry versus wet grinding of coal, and use of ash removal-oil agglomeration, which was carried out by the National Research Council. Techniques were successfully developed to produce consistently stable slurries and identify quality-control tests using a wide range of oils and coals.

Then, over 50 tonnes of coal were dry-ground to a utility particle size and shipped to the Alberta Research Council facilities at Nisku. Slurries were mixed using Unocal's proprietary preparation process, and several pipeline tests were conducted. One test involved trucking a slurry to the site of a 8.1-cm pipeline owned by Unocal, and injecting batches of the slurry into an on-line system. The slurry/oil interface growth was monitored over a 30-km distance and found to be acceptable. Another series of "pipeloop" tests was conducted at the Saskatchewan Research Council to determine the laminar flow and laminar/turbulent transition characteristics of the slurry.

Slurry from the 30-km field test was then returned to Nisku for a series of separation tests. Using commercially available equipment, the slurry was routinely separated in a 3-ton-an-hour screen bowl centrifuge. The recovered coal cake was then dried in an indirectly heated screw-type dryer. The resulting coal product, containing approximately five per cent oil, was shipped to Ontario Hydro for combustion testing. The oil product, containing 1 000 to 2 000 ppm solids, was sent to a refinery-oil cleaning specialist in Houston for removal of the solids by conventional de-salting.

Ontario Hydro reported excellent combustion test results. The residual carbon in the ash was three per cent, and flame stability was rated as "good". The improved thermal content of the coal was attributed to the removal of water and an oil content of approximately five per cent. The results from the oil cleaning tests were also encouraging. An oil containing solids as low as 20 ppm was obtained after treatment.

Coal-Condensate Slurry Pipelining

While the coal-oil slurry research project was still under way, some concurrent developments in another area of research supported by A/CERRF suggested a promising application for coal-slurry transportation. Experiments being carried out near Cold Lake that used a slaging combustor called the LNS Burner suggested that use of coal in place of natural gas to produce the steam needed for in situ extraction of heavy oil is a viable technology. This demonstration, however, would be assisted by some method for reducing the costs of transporting coal from Alberta mines to heavy oil extraction sites.

In a project initiated in 1989/90, a variation on the Unocal coal-oil slurry technology was developed. It takes advantage of the need by heavy oil producers for a hydrocarbon diluent called "condensate". This liquid is currently pipelined to heavy oil production areas, where it is used to dilute the produced heavy oil to facilitate pipeline transport to markets.

Thus, the coal-oil transportation technology was adapted to make use of the condensate and the existing condensate pipelines to transport coal to the heavy oil producing areas. Involved was the development of technology required to prepare coal-condensate slurry, send it through a pipeline to a heavy oil field and separate it into its respective components.

From previous work on the transCOM concept, it was known that certain cost advantages relative to rail haul are likely. For example:

- central coal-grinding facilities benefitting from economies of scale can be located at the mine site;
- the potential combination of a slurry pipeline and the LNS Burner could reduce the need for excess drying equipment;
- coal from various sources could be used because the costs associated with the haul distance from a mine to the user become less important when pipelines are used. Furthermore, the required pipelines already exist; and
- surface handling and storage of coal could be virtually eliminated.

Thus far in the project, it appeared that transportation by slurry pipeline would cost less than by rail. When this cost reduction was combined with a potential rise in the cost of natural gas, the opportunities for using coal in place of natural gas were improved.

To enhance this advantage, technology development was carried out on slurry preparation, transportation by pipeline and separation of the coal-condensate slurry.

This work included the following:

- identification of coal preparation and cleaning requirements;
- development of design parameters for coal-condensate mixtures that can be separated;
- characterization of the transportation properties of coal-condensate slurries;
- development of a technology for efficient separation of coal and condensate; and
- analysis of pipeline capacities.

As a result of this work, the performance of all major processing equipment needed to produce and separate coal-condensate slurries was verified. Pilot-scale data on the most critical equipment was acquired for an engineering cost study.

The final step in the development of both the transCOM and coal-condensate processes involved the preparation of process flow charts and cost estimates for a two-million tonne-a-year slurry preparation and separation plant.

During 1990, Bantrel Inc. was sub-contracted by Unocal Canada Limited to carry out this engineering and cost study, with the principal objective of preparing capital and operating cost estimates for the following options:

- transportation of a coal-condensate slurry from the coal mines near Wabamun Lake to Cold Lake, using existing pipelines; and
- transportation of a coal-light crude oil slurry between the Obed Mountain mine and Sarnia, using existing pipelines.

For both options examined, modifications to the existing pipelines, pumping stations and intermediate storage facilities were excluded. Thus, the principal components of both systems were for slurry preparation and subsequent separation of either the coal-condensate or the coal-crude oil.

Plus or minus 25 per cent estimates were prepared for capital and operating costs for both configurations. It was found that the delivered cost of pipeline-transported coal was comparable to that of rail transport when oil was used, and superior to rail haul when using condensate. Detailed information was provided to Unocal, but it is currently regarded as confidential.

Unocal Canada Limited subsequently withdrew from coal mining in Alberta, and is seeking to transfer the transCOM and coal-condensate technologies to interested parties. For additional information about participation in further development of these technologies, contact:

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More information about the Coal Market Access Model is available from:

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